BASEWIDE ENERGY PLAN
PRESIDIO OF SAN FRANCISCO, CALIFORNIA

VOLUME V
EXECUTIVE SUMMARY

OCTOBER 1978

PREPARED FOR

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

SACRAMENTO, CALIFORNIA

CONTRACT DACA05-77-C-0193

PREPARED BY

BLACK & VEATCH

CONSULTING ENGINEERS

KANSAS CITY, MISSOURI

A-4

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EXECUTIVE SUMMARY

A. GENERAL.

The Basewide Energy Plan for the Presidio of San Francisco is contained in five volumes with six separate documents as follows:

- Volume I — Energy Use Survey
  - Part A — Narrative
    Chapters 1 through 5
  - Part B — Appendix
- Volume II — Energy Conservation Considerations
  Chapters 6 through 9
- Volume III — Twenty-five Percent Energy Consumption Reduction
  Chapters 10 through 12
- Volume IV — Renewable Energy Sources
  Chapter 13
- Volume V — Executive Summary

A summary of each chapter comprises the remaining sections of this Executive Summary. Calculations and other data to support the narrative portion of each chapter is included in the appendix of the volume containing the chapter.

B. BASE POPULATION - CHAPTER 1.

Present and anticipated future population of the Presidio of San Francisco are shown in three tables. The tables show the population in terms of resident and non-resident personnel for the categories and total values listed in Table 1.

TABLE 1

BASE POPULATION

CATEGORY	1977	1987	1997
Military	3367	3329	3420
Military dependents	5034	5814	6091
Civilian	3418	3709	4006
Patient (LAMC)	290	335	369
Outpatient (LAMC)	2600	2860	3003
Other services (LAMC & LAIR)	0	22	25
Reserve forces	700	770	787
Visitors	2250	2760	3000
Non-military agencies	410	430	451
Retired DOD military	400	430	450
TDY students	58	180	216
Other TDY	0	41	45

The population figures presented in the tables were compiled from the following three reports:

- Analysis of Existing Facilities Environmental Assessment Report, dated 1 March 1977
- Tabulation of Existing and Required Facilities Installation Strengths (AR 210-20), dated 1 March 1977
- Future Development Plans Analytical/Environmental Assessment Report, dated 1 March 1977

The discussion in the chapter and footnotes to the table indicate the basis for the population projections.

C. WEATHER DATA - CHAPTER 2.

The weather at the Presidio of San Francisco consists of a diversity of microclimates within a small area. The dominating factor causing this diversity is the ridge running generally southeast from the Golden Gate Bridge Plaza to the Presidio Golf Course and south into the residential section of the City of San Francisco. The prevailing winds are from the Pacific Ocean for both summer and winter. The air temperatures and local fogs are significantly different on the windward side of the ridge than on the leeward side; hence, the solar insolation has considerable variation. Thus, the local climate and resulting degree-days for heating varies with location within the Presidio of San Francisco. Furthermore, weather data for the City of San Francisco is different than that of the Presidio; hence any energy analysis should be made using local data and not the generalized data from the downtown San Francisco weather station, at the top of the Federal Office Building, or the National Weather Service airport station, located approximately 15 miles to the south.

Three sets of weather data presented in this chapter of the study are temperature, wind, and solar insolation. They were obtained from actual measurements at specific locations within or adjacent to the Presidio. Comparisons of the Presidio weather data were made with the general San Francisco data so that computer analyses using San Francisco weather tapes could be adjusted accordingly. Degree-days for heating were obtained and were included in the chapter.

Tidal currents are potential energy sources which were investigated in addition to wind and solar insolation. Reports of contacts with various people for procuring the weather data are given in Volume I Part B Appendix. Tables 2 through 6 summarize some of the weather data included in the chapter.

TABLE 2

MAXIMUM, MINIMUM, AND AVERAGE AIR TEMPERATURES (^{o}F)

AVERAGE 1974-1977

LOCATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PRESIDIO: BOWLING CENTER:	49.4	52.2	51.6	51.9	55.3	57.6	57.6	63.3	63.4	61.2	56.4	51.1
LAMC	50.3	55.3	54.7	56.7	60.2	61.3	62.5	64.0	63.2	63.1	57.8	53.2
POST HDQTRS.	48.7	51.8	50.1	52.6	57.4	59.5	59.7	60.6	60.0	59.9	55.3	51.1
FED. OFFICE BLDG:	51.4	53.6	53.0	54.4	56.0	58.4	59.2	60.9	61.0	61.3	57.8	53.5

TABLE 3

MONTHLY AND ANNUAL DEGREE DAYS

													ANNUAL
PRESIDIO: BOWLING CENTER:	377	370	400	299	306	241	184	151	171	185	250	356	3290
FED. OFFICE BLDG: AVG. 1974-77	417	315	363	313	280	213	180	131	134	131	214	348	3040

TABLE 4

OCEAN WATER TEMPERATURES (^{o}F)

FT. POINT	50	51	53	54	55	57	58	59	60	58	55	52

TABLE 5

CUMULATIVE-FREQUENCY DISTRIBUTION OF WIND SPEED

SPEED RANGE	CRISSY FIELD		GOLDEN GATE BRIDGE TOLL PLAZA	
	% FREQ.	CUM.% FREQ.	% FREQ.	CUM.% FREQ.
0-3	21.3	21.3	10.8	10.8
4-6	18.8	40.1	24.1	34.9
7-10	23.4	63.5	34.7	69.6
11-16	21.9	85.4	25.5	95.1
17-27	13.4	98.8	4.6	99.7
28-40	1.2	100.0	0.3	100.0

TABLE 6

MONTHLY MEAN SOLAR INSOLATION ON HORIZONTAL SURFACES AT PRESIDIO AND BAAPCD, DOWNTOWN SAN FRANCISCO

(LANGLEYS/DAY)

MONTH	ACTUAL BAAPCD 5-YEAR AVG.	ESTIMATED PRESIDIO 5-YEAR AVG.
JANUARY	182.5	193.3
FEBRUARY	239.7	239.7
MARCH	347.9	337.3
APRIL	487.3	382.3
MAY	541.3	502.1
JUNE	573.2	429.4
JULY	532.7	493.5
AUGUST	464.5	489.4
SEPTEMBER	413.9	430.6
OCTOBER	296.3	304.8
NOVEMBER	187.3	180.5
DECEMBER	141.4	144.9

D. PURCHASED ENERGY SOURCES - CHAPTER 3.

In order to facilitate development of an energy consumption model and determine usage patterns peculiar to the Presidio of San Francisco, historical energy use data were gathered for the last three fiscal years. These data were in the form of actual utility bills from Pacific Gas and Electric Company, boiler house logs, and records maintained by the Facilities Engineer. Additional data on energy use were gathered by metering electricity and natural gas consumption for selected facilities and groups of facilities. The primary energy sources for the Presidio are natural gas and electricity, both supplied by Pacific Gas and Electric Company (PG&E). Fuel oil can be used by the central boiler plant serving the Letterman Army Medical Center and Letterman Army Institute of Research, but has been burned for only 60 days of the last three years.

Electrical energy consumption was metered at Wherry Housing, Buildings 333 through 345, even numbered buildings from 742 through 760, and 770 and 772, Letterman Army Medical Center, Letterman Army Institute of Research, Building 38, Building 1750, Building 1244, and Building 605 for approximately two months. This metering was accomplished for the purpose of this study only. Natural gas consumption has been metered for a large number of buildings for several years as a part of PG&E billing methods. The data available from PG&E billing were incomplete, but sufficiently comprehensive to verify the results of energy consumption calculations. Energy consumed for domestic hot water production was also metered as a part of this study.

For the past 12 years, Pacific Gas and Electric Company has derived an average of 49 percent of its energy production from sources other than fossil fuel burning plants. Future expansion plans for electric energy production facilities call for nuclear, geothermal, hydroelectric and coal fired plants, with no plans for oil or gas fired expansion. Natural gas is purchased from production facilities and pipeline operators in Texas, Northern California and Canada. Gas purchases have steadily declined since 1967, indicating a continuing conservation effort consistent with decreasing national supplies of natural gas.

Energy use profiles were prepared for fiscal years 1975, 1976, and 1977. Basewide energy consumption data for electrical power, natural gas and No. 2 fuel oil for the last three fiscal years is illustrated in the chapter on Figures 3-1, 3-2, and 3-3. Electrical energy was purchased under six separate accounts and the energy use for the three year period is shown on Figures 3-4 through 3-9. The six separate accounts and percentage of total consumption applicable to each is as follows:

- Main Substation — 91.3 Percent
- 25th Avenue and El Camino — 3.6 Percent
- Wherry Housing — 4.2 Percent
- 2 El Camino Del Mar — 0.7 Percent
- 5th and Lake — 0.1 Percent
- 1599 Lincoln Blvd. — 0.1 Percent

Figures 3-10, 3-11, and 3-12 in the chapter illustrate natural gas consumption for three accounts; Main Post, Ft. Scott, and Family Housing.

Purchased energy was divided into usage by "Reimbursable Accounts" and usage by "Nonreimbursable Accounts". Figures 3-13 through 3-22 illustrate the usage of electrical and natural gas energy for both of these divisions.

Figures 3-23 through 3-33 in the chapter illustrate projected electrical and natural gas energy usage for fiscal year 1978. This projected energy usage is based on present operating conditions and does not consider energy conservation measures described in later chapters. The profiles consider total, reimbursable, and nonreimbursable consumption.

The effect of weather conditions on energy usage is graphically represented in Figures 3-34 and 3-35 in the chapter.

E. ENERGY USE BY BUILDINGS - CHAPTER 4.

In order to accurately predict the energy use of each building at the Presidio of San Francisco, a mathematical model of each building type was developed. The total annual electrical energy usage for the model of each building type was determined by electrical metering, calculated average daily demand profiles, and the E CUBE 75 computer program. The annual energy usage for heating and cooling of the model building of each building type was simulated using a combination of techniques including the Modified Degree-Day calculation method, the Bin Method, and the E CUBE 75 computerized method. The method of simulation chosen for a given building was based upon the type of environmental system installed, the operational characteristics, and the use characteristics of the building under study.

The mathematical model of the post was based on the analysis of 56 typical building types and 41 unique buildings. One hundred and twenty-three minor buildings, such as garages and storage sheds, were also considered. Each of the typical buildings represents a group of similar buildings, ranging in number from two to 84. Two hundred and eleven buildings consume no energy and were not included in the model. The buildings were sorted by computer on the basis of building category codes, construction types, fuel usage and age. Within a building group, the construction, use, occupancy schedule, and equipment are similar. Typical buildings were selected from each group to represent the entire group.

The chapter gives a description of the building groups into which each building on the post is classified. There are 6 administrative building groups with 73 total buildings; 11 community service facility groups with 75 buildings including LAMC and LAIR; 30 family housing groups with 375 buildings; 4 maintenance facility groups with 29 buildings; 6 barracks facilities with 33 buildings; 4 unique facilities with 35 buildings; 4 warehouse facilities with 54 buildings and 1 group of 334 buildings that use an insignificant amount of energy.

The unitized calculated energy consumption of each typical building was assumed to be identical to the unitized energy consumption of each building within the group represented by the typical building. Consequently, the predicted energy usage of each building was derived by multiplying the unitized energy consumption by the area of each building in the group. The results of this operation were tabulated in Table 4-1 of the chapter along with the characteristics of each building. Table 4-1 includes data for every building on the post.

Energy consumption data for individual buildings and groups of buildings are presented in tabular and graphical form in the appendix of Volume I.

F. REGULATIONS - CHAPTER 5.

The Presidio of San Francisco has been designated as a historical site with many buildings already set aside to be preserved as historical buildings. The Presidio, situated in a beautiful environment between the Pacific Ocean and San Francisco Bay and adjacent to the Golden Gate Bridge and recreational areas, is a popular tourist attraction for the people of the city of San Francisco and surrounding communities, the state of California, and the entire United States. The Presidio is, however, also an Army installation and required by various edicts and regulations to reduce the use of fossil fuel energy sources. With these facts in mind, energy conservation measures must be implemented to meet energy use regulations, but all energy conservation considerations must also assure the preservation of the historical and environmental qualities of the Presidio. For these reasons this chapter highlights and summarizes various regulations governing energy use, environmental quality and master planning as applicable to the Presidio of San Francisco and to the scope of this study.

The energy regulations highlighted and summarized in the chapter are the following:

• Army Energy Program	AR 11-27 with FORSCOM Supplements 1 and 2 PSF Supplement 1
• Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems	AR 420-49
• Utilities Utilization Program	PSF Reg 11-3
• Utilities Management Analysis	AR 420-44

The environmental regulations highlighted and summarized are the following:

• Army Environmental Program	AR 200-10 with FORSCOM Supplement 1
• Environmental Protection and Enhancement	AR 200-1 with FORSCOM Supplement 1

The implementation of energy conservation measures that will require modifications to buildings and systems will not only have to consider the requirements previously covered under environmental regulations but also other agreements between the Presidio of San Francisco and Federal, State and local governmental agencies. Federal government regulations and other governmental agencies entering into agreements include the following:

- The Antiquities Act of 1906
- Historic Sites Act of 1935
- National Historic Preservation Act of 1966
- National Environmental Policy Act of 1969

- Archaeological and Historic Preservation Act of 1974
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 1971
- California Coastal Zone Conservation Commission
- California Department of Transportation
- Association of Bay Area Governments
- Bay Conservation and Development Commission
- Golden Gate Bridge Highway and Transportation District
- City and County of San Francisco

G. ENERGY COSTS - CHAPTER 6.

The chapter consists of a discussion of the projected cost of electrical and natural gas energy for fiscal years 1978, 1979, and 1980 compared to the energy costs for fiscal year 1977. Electrical energy rates are projected to be 84 percent, 89 percent, and 103 percent of the FY-77 rate for FY-78, FY-79, and FY-80, respectively. Natural gas rates are projected to be 115 percent, 132 percent, and 152 percent of the FY-77 rate for FY-78, FY-79, and FY-80, respectively.

Table 6-1 in the chapter shows the projected cost of energy for lighting, electrical for cooling, and natural gas on a dollars per square foot basis for the total building area of each typical building group as determined in Chapter 4. These projected costs are for FY-78, FY-79, and FY-80 and are the costs that might be expected without implementation of the energy conservation measures discussed in later chapters.

H. LOAD SHEDDING - CHAPTER 7.

The purpose of load shedding is to reduce the peak electrical power demand in order to reduce the cost of electrical energy. The total amount of energy used is not necessarily reduced; but the power demand charge, which accounts for about 17 percent of the total cost of electrical energy, is reduced.

When the survey portion of this study was undertaken, the Presidio had six separate accounts with the electric utility. Presently, three smaller accounts are being consolidated with the main substation account. This leaves only three electrical accounts with only Main Substation and Wherry Housing having a demand charge.

1. Main Substation. With the consolidation of electrical service on this account, the Main Substation account comprises about 96 percent of the electrical energy purchased by the post. From demand profiles shown in Volume 1, Chapter 3, Figures 3-16 and 3-18, it is evident that there is no sharp peak of demand which might be identified with a specific time of day and electrical load, and which in turn could be demand limited. In order to limit the power demand, loads would require control from 9 a.m. to 4 p.m. Since there are no large single unnecessary loads that may be eliminated during this period, only a general overall reduction in power requirements will reduce the total demand and not cause disruption of normal workday activity. This demand reduction must be accomplished on a building by building basis. This building by building analysis is included in Chapter 8 of the study.

2. Wherry Housing. This electrical account consists of only family housing and associated street lights, and represents about 4 percent of the electrical energy used on the post. Calculations show that demand limiting for this account is not economical or practical.

I. COST REDUCTION - CHAPTER 8.

Cost reduction measures are often intimately related to energy conservation measures. Operating expenses are directly related to energy consumption, maintenance costs, and energy demand charges. Demand charge reduction may reduce costs without reducing consumption; but most operating cost reduction measures will result in reduced energy consumption. It is also true that virtually all energy conservation measures will result in operating cost reductions.

Several energy conservation and demand reduction measures were considered and discussed in the chapter. A detailed analysis of selected measures is found in Chapter 10.

1. Electrical. Those measures followed by an asterisk are not recommended for implementation.

- Replace fluorescent lamps in existing indoor fixtures with energy efficient fluorescent lamps and ballast systems.
- Replace existing three-phase motors in the 1 to 125 hp range with new energy efficient types.
- Replace incandescent street lights in the Wherry Housing area with high pressure sodium luminaires.
- Regulate the use of residential clothes dryers.*
- Replace residential incandescent ceiling lighting fixtures with small circular fluorescent lamp and ballast system.
- Consolidate primary distribution systems into one account to save on demand charges.
- Replace main substation street lighting with high pressure sodium luminaires.*
- Correct power factor on the Main Substation and on the 25th Avenue and El Camino distribution.*
- Replace transformers with energy efficient dry type transformers.*

2. Mechanical. Those considerations followed by an asterisk are not recommended for implementation at the present time.

- Provide electric ignition for all existing heating boilers.*

- Disable domestic water heaters in several administrative facilities.
- Replace gas-fired water heaters with electric water heaters.*
- Install time clocks to control heating boilers.
- Install a central automation system for major buildings.*
- Replace residential heating boilers with modern units.
- Replace residential water heaters with energy-conserving models.*
- Add outdoor reset controls to heating water boilers.*
- Install heat reclaim equipment for LAMC and LAIR.
- Generate heating water for LAMC and LAIR by direct steam injection.*
- Use cooling towers to provide chilled water during intermediate seasons.*
- Replace heating systems with heat pumps.*
- Install automated control system for central boiler plant.
- Convert several boilers to a more abundant fuel.*
- Change chilled water controls to regulate return water temperature rather than supply water temperature.
- Repair steam leaks.
- Balance and adjust existing heating, ventilating, and air-contitioning systems.
- Install flue restrictors in family housing heating units.
- Install toilet tank restrictors in all tank type water closets.
- Install shower head flow restrictors.
- Install economizers on boilers in Building 1040.
- Fire central boilers with vehicle waste oil.*
- Operate LAMC and LAIR chillers at night and store chilled water.*

3. Architectural. Those modifications followed by an asterisk are not recommended for implementation.

- Install roof insulation in family housing and administration facilities.
- Weatherstrip and calk doors and windows.

• Double glaze existing windows.*

• Install storm windows on existing windows.*

• Reduce window area.*

4. Operations. Those changes followed by an asterisk although recommended, will require study by post personnel.

• Change occupants for natural gas usage.

• Consolidate computer operations.*

• Consolidate operations and close vacated buildings.*

• Improve the preventive maintenance program basewide.*

J. PARAMETERS FOR FUTURE INSTALLATION AND CONSTRUCTION - CHAPTER 9.

Consideration must be given to obtaining and implementing more energy efficient designs for new buildings. The incorporation of more effective methods of minimizing heat loss, more effective methods of energy conversion and distribution, and provision for heat recovery equipment to conserve energy is a must. The design team must be encouraged and directed to invest the time, effort, and knowledge to provide energy efficient design without obstruction from traditional conceptions. This chapter is devoted to the listing of parameters for future installations and construction.

The parameters discussed in the chapter are as follows:

1. Energy Monitoring and Control Systems.

2. Building Utilization and Plan.

3. Architectural Considerations.

   • Building orientation
   • Window and glass area
   • Building exterior
   • Insulation

4. Mechanical Considerations.

- Boilers
- Furnaces
- Heat distribution
- HVAC systems
- Air handling systems
- Water heating systems

5. Electrical Considerations.

- Service voltage
- Phase selections
- Service entrance metering
- Transformers
- Power factor improvement
- Voltage drop
- Peak demand reduction
- Motor efficiency
- Lighting
- Energy financial responsibility

K. REDUCTION OF ENERGY USE - CHAPTER 10.

A number of energy conservation and cost reduction measures were described and partially evaluated in Chapter 8. Those measure which show the greatest potential for economically attractive energy conservation are analyzed in greater detail in this chapter. Those items which are found to be economically sound are recommended for implementation and a suggested timetable is included.

Incorporation of all of the recommended building modifications will result in energy savings calculated to be 25.6 percent of the total energy consumed in FY-75. Several operational changes are recommended for further study by post personnel which may result in considerable additional savings. Other modifications may become economically attractive in the near future as technology advances and energy costs increase.

Each of the various energy conserving schemes was evaluated under criteria established for the Energy Conservation Investment Program and scheduled for implementation in order of decreasing E/C ratio based on FY-81 construction costs. Projects showing a benefit-to-cost ratio of less than unity were rejected regardless of other considerations.

The results of the ECIP calculations are summarized in Tables 10-1 through 10-4 in the chapter. These four tables are repeated in this Executive Summary as Tables 7 through 10. Only those measures recommended for implementation are discussed in the chapter.

In order to derive the greatest benefit-to-cost ratio, those ECIP items with the highest E/C ratio should be implemented first. Table 10-5 in the chapter, and repeated in the Executive Summary as Table 11, ranks the recommended ECIP projects in order based on the E/C ratio and also shows the total estimated project cost and energy savings.

A graphical presentation of progress for the entire program is presented on Figure 10-1 in the chapter and repeated in the Executive Summary as Figure 1.

TABLE 7

SUMMARY OF ELECTRICAL ECIP's

ECIP NUMBER	PROJECT DESCRIPTION	ENERGY SAVED MMBtu/Yr.	BENEFIT / COST	E/C	PAYBACK PERIOD YR.	RECOMMENDED
E1	Fluorescent Lt.	17,365	1.62	43.4	4.0	Yes
E2	High Eff. Motors	4,428	2.72	44.2	6.2	Yes
E3	Street Lighting	357	1.71	26.3	10.0	Yes
E4	Clothes Dryers	0	0.84	0.0	12.0	No
E5	Res. Kitchen Lt.					
	a. Wherry	707	2.15	23.0	7.8	Yes
	b. Other	1,092	2.04	23.0	8.2	Yes
E6	Cons. Accounts	0	6.17	0.0	2.9	Yes
	TOTAL	23,949				

TABLE 8

SUMMARY OF MECHANICAL ECIP's

ECIP NUMBER	PROJECT DESCRIPTION	ENERGY SAVED MMBtu/Yr.	BENEFIT / COST	E/C	PAYBACK PERIOD YR.	RECOMMENDED
M1	Electric Igniters	638	0.21	5.0	58.8	No
M2	Disable W.H.	4,233	92.74	1360	0.22	Yes
M3	Electric W.H.	3,093	-5.95	4.2	-	No
M4	Time Clocks	36,456	49.50	1170	0.25	Yes
M5	Automation System	-	-	-	-	No
M6	Replace Boilers	38,759	4.13	64	4.61	Yes
M7	High Eff. Gas W.H.	7,068	0.54	8.4	34.9	No
M8	Outdoor Reset	-	-	-	-	No
M9	Heat Reclaim	37,891	14.64	226	1.30	Yes
M10	Steam Injection	-	-	-	-	No
M11	Cooling Tower	-	-	-	-	No
M12	Heat Pumps	63**	-0.60	15.5	-	No
M13	Boiler Controls	10,570	8.49	201	1.46	Yes
M14	Coal Fired Boiler	0	0.73	0	54.0	No
M15	Chiller Controls	3,727	183.00	961	0.10	Yes
M16	Repair Leaks	1,220*	29.00	425	0.69	Yes
M17	Balance & Adjust	23,893	53.48	692	0.35	Yes
M18	Flue Restrictors	31,044	33.16	512	0.57	Yes
X M19	Tank Restrictors	45	1.53	8.4	11.2	Yes
M20	Flow Restrictors	9,529	19.39	300	0.98	Yes
M21	Economizers	12,630	4.14	64	4.59	Yes
M22	Waste Oil	1,584	0.85	16.7	31.7	No
M23	Ch. Water Stor.	-	-	-	-	No

* Assume 10 steam leaks, basewide

** Typical for one family housing unit

TABLE 9

SUMMARY OF ARCHITECTURAL ECIP's

ECIP NUMBER	PROJECT DESCRIPTION	ENERGY SAVED MMBtu/Yr.	BENEFIT COST	E/C	PAYBACK PERIOD YR.	RECOMMENDED
A1	Ceiling Insulation	36,229	7.08	109	2.70	Yes
A2	Ceiling Insulation	10,394	5.18	80	3.67	Yes
A3	Weatherstrip	7,185	4.88	75	3.90	Yes
A4	Weatherstrip	18,593	1.88	29	10.12	Yes
A5	Dbl Glaze	-	-	-	-	No
A6	Storm Windows	-	-	-	-	No
A7	Reduce Windows	-	-	-	-	No

TABLE 10

SUMMARY OF OPERATIONAL ECIP's

ECIP NUMBER	PROJECT DESCRIPTION	ENERGY SAVED MMBtu/Yr.	BENEFIT COST	E/C	PAYBACK PERIOD YR.	RECOMMENDED
Ø1	Gas Charge	22,770	-	-	-	Yes
Ø2	Consol. Computer	-	-	-	-	Yes*
Ø3	Consol. Operation	-	-	-	-	Yes*
Ø4	Prevent. Maint.	-	-	-	-	Yes*

* Project must be studied by post personnel

TABLE 11

ORDER OF ECIP IMPLEMENTATION

YEAR	ECIP NO.	E/C	ENERGY SAVINGS MMBtu/yr	TOTAL COST $
79	01	infinity	22,770	0
	M2	1,360	4,233	3,112
	M4	1,170	36,456	32,843
80	M15	961	3,272	3,404
	M17	692	23,893	34,549
	M18	512	31,044	63,840
81	M16	425	1,220	287
	M20	300	9,529	33,508
	M9	226	37,891	176,443
	M13	201	10,570	55,472
82	A1	102	36,229	349,173
	A2	80	10,394	136,842
	A3	70.65	7,185	100,326
83	M6	64	38,759	639,572
	M21	64	12,630	207,856
	E2	44.2	4,428	104,882
	E1	43.4	17,365	363,192
84	A4	29.06	18,593	674,315
	E3	26.3	357	14,327
	E5a	23	707	32,397
	E5b	23	1,092	50,048
	M19	8.4	45	5,586

L. REDUCTION OF NATURAL GAS CONSUMPTION - CHAPTER 11.

An objective of the Federal Energy Management Program is to reduce natural gas consumption in Federal facilities by 50 percent of current consumption by 1985. Attainment of this or any other possibly more stringent DOD/DA objective, can only be accomplished by observance of prudent fuel economy and utilization of alternative fuels. When speaking of large boiler plants, the most logical alternative fuels are solid fuels; either coal, wood, wood by-products, or solid waste. Because of the limited availability of wood or wood by-products in the San Francisco area, and of the undesirable variable heat content of solid waste, only coal has been considered as a more abundant fuel for boiler feed. The criteria for this project requires that all boilers with capacities greater than 1,000,000 Btu's per hour be considered for conversion to a more abundant fuel. Since the only available more abundant fuel is coal, boilers of capacities as low as 1,000,000 Btu's per hour are not economically suitable conversion. As an alternative to converting small individual boilers to coal firing, a plan was developed in the chapter to construct a new central steam plant using stoker fired coal as a fuel, which will replace all but one of the boilers of greater than 1,000,000 Btu per hour capacity. The location for this new plant would be in the 600 area where Buildings 607 through 653 are currently located. Each of these buildings is scheduled for demolition in the near future, leaving approximately 6 acres for construction of the proposed plant and associated coal handling and storage facilites.

This project is not considered suitable for ECIP funding, since there is no actual energy savings and the benefit to cost ratio and E/C ratio is equal to zero. Furthermore, the payback period for a plant of this size is excessively long.

The chapter contains a discussion of plant capacity, very basic plant design, plant siting, steam distribution system, and plant and distribution system cost.

The actual energy savings attributable to providing heat for multiple individual buildings from a central steam plant will be minimal since the same entire demands of each of the individual buildings will be served by the new plant. However, under present practices, these heating needs are satisfied by burning natural gas in individual heating plants. By firing the proposed new plant with stoker fired coal, the entire 384,158 mega Btu's energy consumption will be diverted from natural gas to a more abundant source of energy. By virtue of installing new terminal equipment in several locations, certain efficiencies may be improved which may result in an actual decrease in total energy consumed. This amount of energy savings is essentially indeterminate and any attempt to quantify it would be based on conjecture. Even without taking credit for increased plant efficiency, this project alone would be sufficient to meet the Army's goal of a 50 percent reduction in natural gas usage by 1985.

M. PROJECTED UNITIZED ENERGY COSTS - CHAPTER 12.

The projected energy costs given in Chapter 6 are based on continued operation in accordance with the mathematical model used in the simulation and energy cost escalation rates derived in that chapter. If the recommended ECIP measures are implemented, it is obvious that these costs will no longer be applicable. Since the unitized cost projections are included only through FY-80, at which time the Energy Conservation Investment Program will have just begun, the decision was made to provide projected costs based on completion of all ECIP measures prior to FY-79.

Table 12-1 in the chapter contains the same information as Table 6-1 in Chapter 6, except the projected costs for fiscal years 1978, 1979, and 1980 are with all recommended ECIP measures as analyzed in Chapter 10 as having been implemented.

N. RENEWABLE ENERGY SOURCES - CHAPTER 13.

The depletion of the United States natural gas and oil reserves has been an impetus to study various sources of renewable energy for all Department of Defense installations. Hence, a review of all types of these sources was made for the Presidio of San Francisco. Four renewable energy sources were evaluated in detail in the chapter. These sources are wind, solar energy, tidal currents/wave action, and air/ocean sensible energy. Other renewable energy sources were not analyzed. Combustion of solid wastes for steam generation is not practical at the Presidio because of lack of acceptable land in this historic region for the plant, the heavy amount of truck traffic necessary to support the plant, and the lack of sufficient combustible solid wastes at the Presidio to justify the cost of such a plant. Currently, there is a joint effort by Pacific Gas & Electric Company and the solid waste hauling contractors to develop such a plant in southern San Francisco. When this plant is operational, all combustible solid wastes of the San Francisco area including the Presidio will be processed there. Generation of steam/electrical power with a wood-fired plant is not practical for the same general reasons as for solid wastes. Energy from geothermal wells is not available because of the lack of hot steam regions below the Presidio. Gas generation from biomass is not conceivable at the Presidio because of real estate restrictions and lack of material for plant operation.

The steady wind that is experienced at the top of the ridge traversing the Presidio in a southerly direction suggests utilization of wind as a renewable energy source. An area approximately 800 feet long in the Ft. Scott area is one of the most viable sites for a wind machine installation for generating electric power. The proposed concept consists of an array of 56 wind machines, each with 16-foot diameter propeller, alined in two rows of 28 machines with 30-foot spacing in each row. Electric power generated by the system would be inverted to ac power by solid state circuitry, transformed to 4,160 volts, and applied to the distribution system of the substation serving the Fort Scott area. The feasibility of the wind-electric power generation system depends on the results of an economic analysis for an expected 25 year life of the installation. The results of the life cycle cost analysis for the proposed concept indicate that the 259,030 kWh annual electric generation represents 1,502 mega Btus of fossil fuel energy. The estimated FY-81 cost for the installed system is $864,000, but the net present value of the energy generated for 25 years is $286,000. The discounted benefit-to-cost ratio is 0.285 and the energy-to-cost (E/C) ratio is 1.8. The simple payback period is 70 years. Because of the excessive cost of the presently developed wind machines, which causes these unacceptable values, the wind/electric generation concept is not feasible.

The utilization of solar energy at the Presidio can provide a significant reduction of natural gas usage providing the economics of solar energy systems will justify installation of the systems. Four areas were investigated for possible solar system installation.

- Domestic water heating for Wherry Housing area
- Space heating and domestic water heating for Wherry Housing area
- Domestic water heating for Building 34
- Domestic water heating for 700 and 800 series family housing

The analysis for all solar systems shows that the systems are not feasible because their installation costs are too great and gas rates are too low for acceptable E/C ratios and payback periods. Table 13-3 in the chapter and repeated in this Executive Summary as Table 12, indicates that the most feasible solar energy system for the Presidio is space heating and domestic water heating for individual families at Wherry Housing. However, the economic considerations cause the system to be unacceptable since the payback period is longer than the expected life of the system.

TABLE 12 ECONOMIC AND ENERGY DATA FOR SOLAR SYSTEMS AT THE PRESIDIO

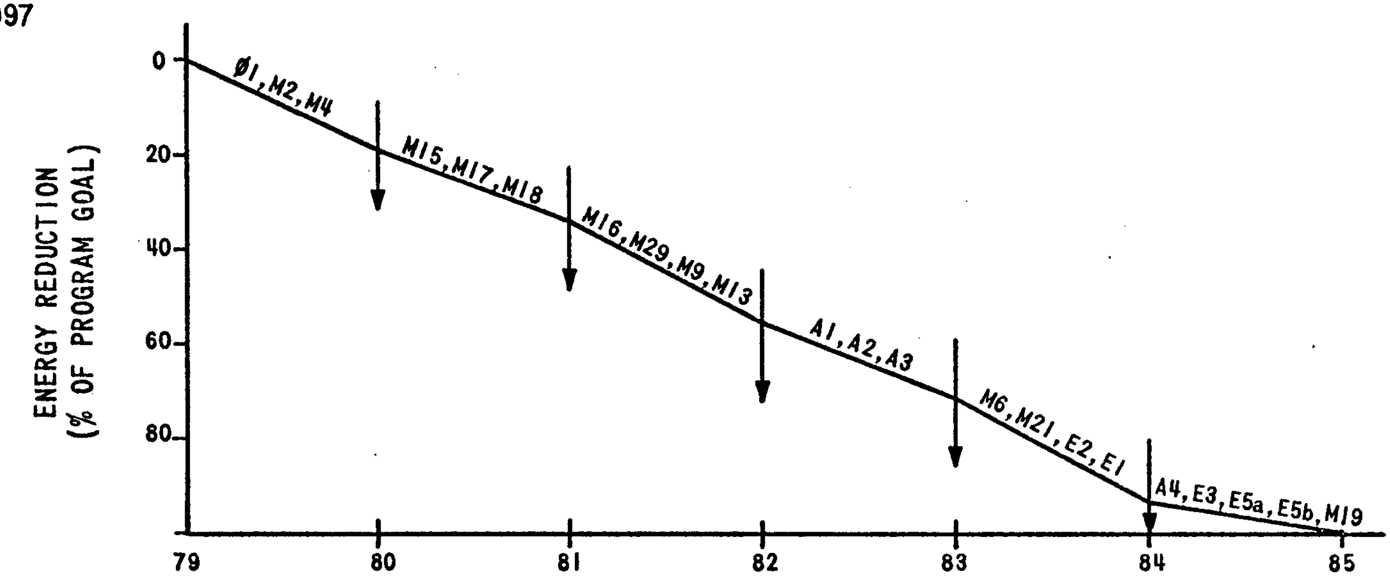
SYSTEM	FY-81 COSTS $	ANNUAL ENERGY SAVINGS MEGABTU	ENERGY/ COST RATIO	PAYBACK PERIOD YEARS
DOM. WTR.-WHERRY HOUSING SINGLE FAMILY	2,640	18.54	7.4	58.2
SPACE HTS. & DOM. WTR. WHERRY HOUSING-SINGLE FAMILY	11,395	128.4	11.9	30.8
DOM. WTR.-MAIN POST SINGLE FAMILY	2,640	20.64	8.2	51.1
DOM.WTR.-MAIN POST COM. & COMPUTER CENTER	6,075	62.37	10.8	34.5

A potential source of renewable energy for the Presisio is the tidal currents through the Golden Gate. However, because of local restrictions, the installation of water turbines for generating electricity could only be installed below the operating depth of surface pleasure craft south of the bridge pier, and below the operating depth of ocean-going vessels in the main shipping channel. The turbulent flood tides south of the pier would cause any installation concept at this location to be extremely expensive as the water flow turbulence would have to be converted to uniform flow before the tides could be used to power water turbines. The conceptual design for an installation of a water-turbine/ electro-generation station submerged below the shipping channel would be an advancement of the state-of-the-art and is beyond the scope of this study. Hence, the use of tidal currents is not feasible as a renewable energy source for the Presidio. The use of wave action as a renewable source of energy is in the same category as tidal currents. Several concepts are being developed but no installation has been operated. A Japanese concept may prove economically feasible in regions of high waves, but the relatively low ocean waves off the Presidio would generate a very limited quantity of electric energy. Hence, the use of wave action as a renewable energy source is not feasible for the Presidio.

The heat content of air and the water of the ocean is a sensible energy source available at moderate temperatures at the Presidio and is a virtually unlimited source of low grade energy. However, a heat pump must be used to convert this energy to temperature level sufficient for heating purposes. In order to utilize this low grade energy, a small air-to-air heat pump must be used in each family unit with an entirely new heat distribution system, or an air-to-water heat pump connected to older family units with hot water heating must be employed. The concept of a centralized heat pump with a hot water circulation loop could also be installed to utilize this low grade energy for heating. An economic analysis, described in Chapters 8 and 10, indicates that heat pumps cannot be justified for a retrofit installation when air-conditioning is not required.

FY-75

ENERGY CONSUMED 1,282,298 MMBTU
FLOOR AREA 6,365 MSF
BASE POPULATION 17,997



FY-85

ENERGY CONSUMED 1,025,794 MMBTU
FLOOR AREA 6,365 MSF
BASE POPULATION 20,097

FIGURE 1
PROGRESS REPORT
% OF ENERGY REDUCTION
OF TOTAL PROGRAM